Effect of Stress on the Olivine-Spinel Phase Transformation in Fayalite *	X17B1

J. Chen, D.J. Weidner, J. B. Parise, M.T. Vaughan (SUNY, Stony Brook)

Following the previous study on the olivine-spinel phase transformation in fayalite [1], we carried out further experiment to investigate the stress effect on the transition. Olivine-spinel phase transformation has been considered as one the major transitions in the earth subducting slab. Study of this phase transformation is very important for understanding the mantle dynamic phenomena such as deep focus earthquakes. Kinetics study is also crucial to construct the subducting slab structure.

Using the translating imaging plate (TIP) system at the X17B1 beamline [2], we were able to monitor the phase transition by time resolved x-ray diffraction. The multi-anvil press SAM85 was used to generate the high pressure and temperature. In the previous experiment was compressed into the spinel stability field at room temperature and then heated to high temperature to drive the phase transformation. The olivine phase started to transform into spinel phase while it was highly stressed. To study the effect of stress on the phase transition, we annealed the sample before it was compressed into the spinel stability field in the current experiment. The sample was then compressed into the spinel stability field. Most of the deviatoric stress introduced during the cold compression was released by the annealing. Therefore the olivine phase held little stress when the transformation started. We have observed that the transition temperature in the annealed sample is about one hundred degree higher than that in the highly stressed sample, and the temperature range for two phases coexisting in the annealed sample is also wider. The experimental data will be further analyzed by structure refinements to study the transformation mechanism.

References

[1] J. Chen and D. J. Weidner, NSLS Activity Report, 1997 pp. B-129.

[2] J. Chen, D. J. Weidner, M. T. Vaughan, R. Li, J. B. Parise, C. C. Koleda, and K. J. Baldwin, Review of High Pressure Science and Technology, 7 (1998) 272 - 274.

* Work was supported by the NSF Grant #EAR 89-20239 to the Center for High Pressure Research, and by US DOE contract #DE-AC02-98CH10886 to the NSLS